NOAA National Severe Storms Laboratory

Warn-on-Forecast

NOAA's Warn-on-Forecast research project aims to create computer-model projections that accurately predict storm-scale phenomena such as tornadoes, large hail, and extreme localized rainfall. If Warn-on-Forecast is successful, forecasters will be provided with reliable guidance for issuing tornado, severe thunderstorm, and flash flood warnings up to an hour before they strike.

Warn on detection (The present)

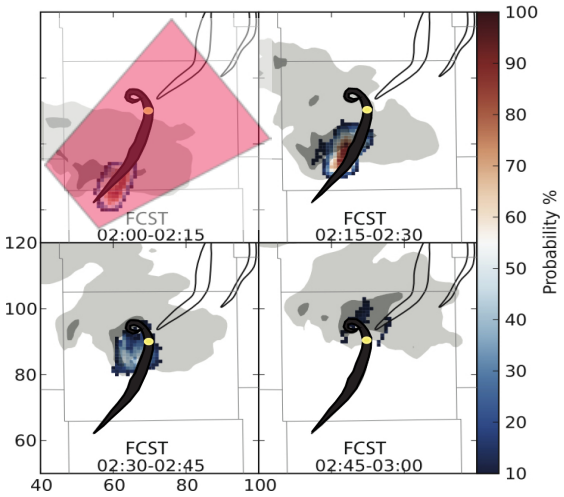
With current technology, warnings for specific severe phenomena such as tornadoes are not issued until their immediate precursors are evident on radar or they are visually identified. This approach allows NOAA National Weather Service (NWS) forecasters to provide the public with an average of 14 minutes advance notice before a tornado strikes. For some needs, this is not sufficient lead time to take appropriate action to keep people safe.

Warn-on-Forecast (The Future)

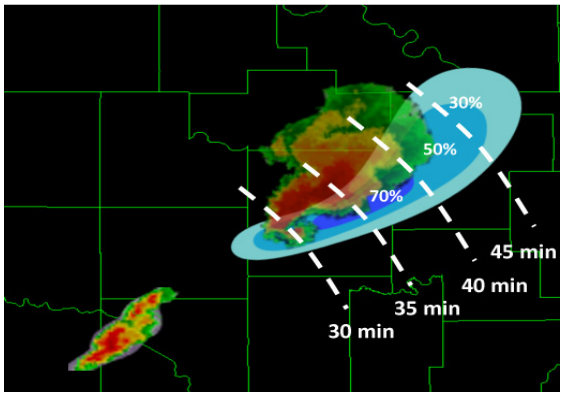
Warn-on-Forecast researchers are working to create a suite of highly detailed computer-model forecasts. This unique modeling system will take advantage of new weather observations and radar scanning capabilities, including those from the fast scanning Multi-function Phased Array Radar. These data will be used to continuously update forecasts in response to the rapidly changing environment of severe thunderstorms. The Warn-on-Forecast system is designed to enable forecasters to routinely issue tornado warnings with 30-60 minute lead time rather than the current average of 14 minutes.

Predicting the threat

In addition to increased lead time, NWS forecasters believe certain communities would benefit from knowing the confidence associated with predictions of severe weather events. Warn-on-Forecast computer models will produce information on uncertainty associated with different predictions every ten to fifteen minutes. Additional information regarding trends in the threat level would aid decision-makers requiring longer lead-times to take appropriate actions. For example, if the confidence level is low regarding storm path, hospitals may initially choose not to relocate patients that could be injured by the move itself, while stadium staff at large outdoor sporting events may decide to proceed with moving fans to safety.



Greensburg, Kan., May 5, 2007 test case: Probability of strong low-level rotation over 15-minute forecast intervals derived from a Warn-on-Forecast system. Tornado shown by light black lines.



A suite of computer models predicts the path of a potentially tornadic supercell over the next hour. The confidence level that the tornado will affect a given location is highlighted in shades of blue.

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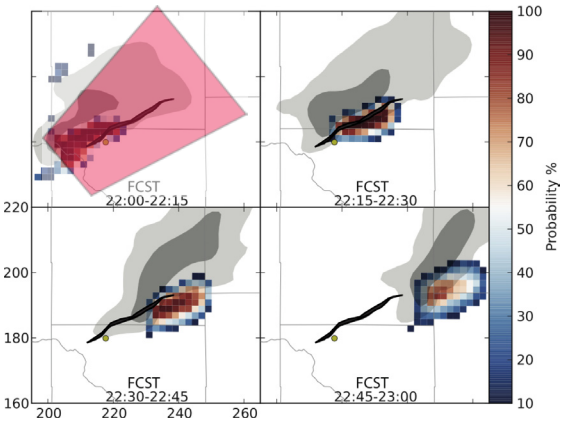
Testing the Warn-on-Forecast concept

As new Warn-on-Forecast technologies emerge, they are tested in simulated forecasting and warning exercises in the NOAA Hazardous Weather Testbed (HWT), ensuring an efficient transition into forecasting operations. In the HWT, Warn-on-Forecast scientists and NWS forecasters have already evaluated multiple building blocks of a future Warn-on-Forecast system, including: 1) Phased Array Radar and its ability to provide more frequent updates than current NWS radars, 2) different techniques to feed radar data into forecast models accurately and quickly, 3) different suites of forecast models that can be combined into a single system representing all possible outcomes for a given weather event, and 4) development of strategies that allow forecasters to rapidly interpret computer-model guidance and add value in generating prototype forecast products.

Forecasters and researchers evaluate prototype Warn-on-Forecast components in the Hazardous Weather Testbed



Oklahoma City, Okla., May 3, 2008 test case: Probability of strong low-level rotation over 15-minute forecast intervals derived from testing of a Warn-on-Forecast suite of models. Note excellent comparison to observed tornado track (light black line).

Potential benefits

Warn-on-forecast has the potential to benefit many weather users that require longer warning lead times to minimize life-threatening weather impacts on their communities. For example, accurate 30-60 minute, neighborhood-scale forecasts of extreme weather events could allow:

- Operators of hospitals and nursing homes time to move patients and residents to safety.
- Operators of large venues such as sports stadiums to move thousands of people from exposed locations to safety.
- Local municipalities to evacuate residents from low-lying areas prone to flash flooding.
- Airports to divert traffic and take protective measures for aircraft on the ground.
- Local transportation departments to plan for possible disruptions in traffic
- Renewable energy operators to prepare for disruptions and imbalances on electric grids.
- State and local governments up to an hour to optimally position emergency response resources.

Engaging social scientists

Providing the public more time to prepare for a potential disaster holds great promise for protection of life and property, but the extra time must be used wisely. To ensure that this happens, physical scientists from the Warn-on-Forecast project are collaborating with social scientists from the government, academia, and private industry. This collaboration aims to ensure that the broader Warn-on-Forecast initiative results in weather information that will benefit decision makers, emergency managers, and the general public so they respond appropriately and reduce the loss of life and property.

Supporting a Weather Ready Nation

The Warn-on-Forecast research project targets NOAA's strategic goals to increase warning lead times for tornadoes, severe thunderstorms, and flash floods in support of the Weather Ready Nation initiative. Warn-on-Forecast is led by NSSL and represents a collaborative effort across several NOAA groups including the Earth System Research Laboratory, the Storm Prediction Center, and the Norman NWS Forecast Office. Academic collaborators are the Center for Analysis and Prediction of Storms, and the Cooperative Institute for Mesoscale Meteorological Studies at the University of Oklahoma.